

**WHAT IS CLAIMED IS:**

- 1        1. A structural element comprising::  
2              a grating base member formed solely by a plurality of main bearing  
3              bars and without distribution or tertiary bars, said main bearing bars spaced to define  
4              interstices therebetween, said main bearing bars having an upper portion and a bottom  
5              portion;  
6              a top component fixed to said grating base member, said top  
7              component in compression under service loads in the direction normal to the main  
8              bearing bars, said top component having a planar top surface and a planar bottom  
9              surface, said planar bottom surface of said top component being substantially above  
10             the bottom portion of said main bearing bar so that said top component does not fill  
11             the interstices of said grating base member;  
12             said upper portions of said plurality of main bearing bars defining a  
13             shear transfer element, and said shear transfer element embedded within said top  
14             component.  
15
- 1        2. The structural element as recited in claim 1, wherein said top  
2           component compression is provided by prestressing.
- 1        3. The structural element as recited in claim 1 wherein said top  
2           component compression is provided by post-tensioning.
- 1        4. The structural element as recited in claim 2 wherein prestressing  
2           strands are placed within the top component transverse to the main bearing bars.
- 1        5. The structural element as recited in claim 3 wherein post-tensioning  
2           tendons are placed within the top component transverse to the main bearing bars.
- 1        6. The structural element as recited in claim 4, wherein the upper portion  
2           of one or more of said main bearing bars comprise a plurality of spaced holes formed

3       in said main bearing bar for providing an enhanced connection between the grating  
4       component and the top component.

1           7.       The structural element as recited in claim 4, wherein the upper portion  
2       of one or more of said main bearing bars comprise a plurality of spaced "C" shaped  
3       recesses formed in said main bearing bar for providing an enhanced connection  
4       between the grating component and the top component.

1           8.       The structural element as recited in claim 4, wherein the upper portion  
2       of one or more of said main bearing bars comprise a plurality of spaced "U" shaped  
3       recesses formed in said main bearing bar for providing an enhanced connection  
4       between the grating component and the top component.

1           9.       The structural element as recited in claim 7, wherein at least one of  
2       said prestressing strands is positioned within at least one of said recesses formed in  
3       said main bearing bars.

1           10.      The structural element as recited in claim 8, wherein at least one of  
2       said prestressing strands is positioned within at least one of said recesses formed in  
3       said main bearing bars.

1           11.      The structural element as recited in claim 5, wherein the upper portion  
2       of one or more of said main bearing bars comprise a plurality of spaced holes formed  
3       in said main bearing bar for providing an enhanced connection between the grating  
4       component and the top component.

1           12.      The structural element as recited in claim 5, wherein the upper portion  
2       of one or more of said main bearing bars comprise a plurality of spaced "C" shaped  
3       recesses formed in said main bearing bar for providing an enhanced connection  
4       between the grating component and the top component.

1           13.      The structural element as recited in claim 5, wherein the upper portion  
2       of one or more of said main bearing bars comprise a plurality of spaced "U" shaped

3        recesses formed in said main bearing bar for providing an enhanced connection  
4        between the grating component and the top component.

1            14.        The structural element as recited in claim 12, wherein at least one of  
2        said post-tensioning tendons is positioned within at least one of said recesses formed  
3        in said main bearing bars.

1            15.        The structural element as recited in claim 13, wherein at least one of  
2        said post-tensioning tendons is positioned within at least one of said recesses formed  
3        in said main bearing bars.

1            16.        The structural element as recited in claim 9, wherein said top  
2        component includes reinforcing bars.

1            17.        The structural element as recited in claim 14, wherein said top  
2        component includes reinforcing bars.

1            18.        A structural element comprising:  
2                a grating base member formed solely by a plurality of main bearing  
3        bars and without distribution or tertiary bars, said main bearing bars spaced to define  
4        interstices therebetween, said main bearing bars having an upper portion and a bottom  
5        portion;

6                a top component fixed to said grating base member, said top  
7        component in compression under service loads in the direction normal to the main  
8        bearing bars, said top component having a planar top surface and a planar bottom  
9        surface, said planar bottom surface of said top component being substantially above  
10      the bottom portion of said main bearing bar so that said top component does not fill  
11      the interstices of said grating base member;

12                said upper portions of said plurality of main bearing bars defining a  
13      shear transfer element, said shear transfer element embedded within said top  
14      component;

15                compression-inducing elements within said top component for creating  
16      said compression within said top component, said compression-inducing elements

17 placed within the top component so as to induce compression in a direction normal to  
18 the main bearing bars.

1           19.     The structural element as recited in claim 18, wherein said  
2 compression-inducing elements are placed within the top component transverse to the  
3 main bearing bars.

1           20.    A method of making a structural element comprising the steps of:  
2                 forming a grating base member from a plurality of main bearing  
3 members without distribution or tertiary bars;  
4                 spacing said main bearing bars to define interstices therebetween,  
5                 connecting a top component to said grating base member so that said  
6 top component does not fill the interstices of said grating base member,  
7                 said step of connecting the top component to the grating base member  
8 further comprising the step of embedding upper portions of the main bearing bars  
9 within the top component for transferring shear and for preventing vertical separation  
10 between the top component and said grating base member; and  
11                 creating compression within said top component under service loads in  
12 the direction normal to the main bearing bars.

1           21.     The method of claim 20 wherein the step of creating compression  
2 comprises prestressing the top component.

1           22.     The method of claim 20 wherein the step of creating compression  
2 comprises post-tensioning the top component.

1           23.     The method of claim 22 wherein the step of post-tensioning further  
2 comprises the steps of:  
3                 casting hollow tubes into the top component near the neutral axis  
4 location;  
5                 inserting high strength rods through the ducts; and  
6                 creating a tensile force within the rods to place the rods under tension.